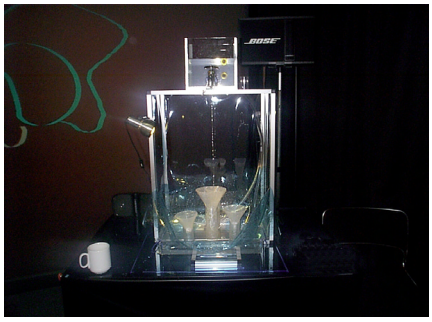
Tangible Sound #2:
Musical Instrument Using Fluid Water



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INTRODUCTION

Tangible Sound is a musical instrument with a novel user interface that uses fluid water. Fluids and sounds change shape over time and thus cannot be grasped. We believe that fluid water is a suitable interface for performing flowing music and so created a live, hands-on installation using water flow as an input medium to control the intuitively appealing feeling of "Musical Tension." We have developed a method of sensing the volume of the water flow corresponding to the enjoyment of the music. For judging a user's actions, we use the changes in the upper flow from the faucet and in the lower flows toward the drains as well as the difference between the two kinds of values.

LEVEL OF INNOVATION

Tangible Sound is a novel system for musically linking sound to the movement of water. The difference in water volume of the upper and lower flows is the simple technique used for sensing the user's input. The graphic output is used to enhance the cognition of note signals from the touch of the water.

The most important thing in sound and music is the characteristic of changing over time (Fig. 1). Furthermore, a fluid's shape also changes over time. When we try to stare at the music to get some information, we feel unstable because it changes with time and cannot be controlled (Fig. 2).

We propose a method for sensing the user's input to the water flow by measuring both the upper volume of flow and the lower volume of flow (Fig. 3). This configuration has led to the novel concept of "Source and Drains," which is applicable to traditional wind instruments. The direct sensing of water provides a more intuitive interface for a musical instrument.

The music software's configuration uses direct input from the water interface to control the signals of musical elements through MIDI technology. The user can control four kinds of harmonies and musical tensions by choosing funnels of different heights that each have a unique level of musical tension.

This musical instrument will become a psychological and cultural amenity of the future.

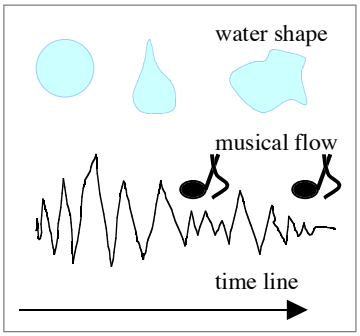


Fig. 1

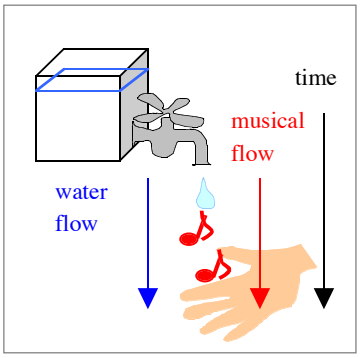


Fig. 2

INTERACTIVE EXPERIENCE

The attendees can directly touch the water flow as a medium to change musical tension. By controlling the source of flow by turning the faucet, they can change the volume and duration of each note. They can also choose the drain into which water flows by touching the water flow. MIDI note signals are made when the funnels receive water flow or water drops. A MIDI note-number is set by the volume of flow into each funnel.

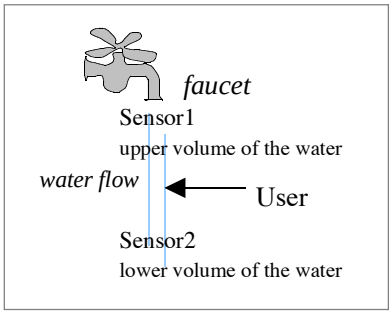


Fig. 3

The sound and music elements continuously and discretely change. The water's feedback is given when the users touch, scatter and stop the water flow. This system was designed to connect the water interface to both music and graphical output. For example, the spread of musical tension and surge of excitement is represented by the water scattering or touching the water flow.

The basic design of this musical instrument is intended for one participant. However, **two or more people** can participate together by using cups to scoop up water from the upper tank or by using their bare hands to change the water flow.

The anticipated duration of the interaction can vary, but it takes about **five minutes** to give a performance and about **one minute** to understand the system intuitively.

We will demonstrate the live installation to provide the participants with hands-on experience. The concept of "Tangible Sound" will become clearer when people touch water and play music with the fluid media.

APPEARANCE

This system produces harmonic notes controlled by water flow.

1) installation description

There are two tanks, one is on the stand and the other is under the stand. The upper tank has a faucet to regulate the water flow. On the lower tank, there are 4 drains made from funnels with varied heights. There is a pump to bring up the water from the lower tank to the upper tank for balancing the amounts of water in each tank. The user can divert (touch, scatter) the water such that some may fall into the main drain and some may scatter into the lower drains. The music volume is controlled by the faucet attached to the upper tank. (Fig. 4)

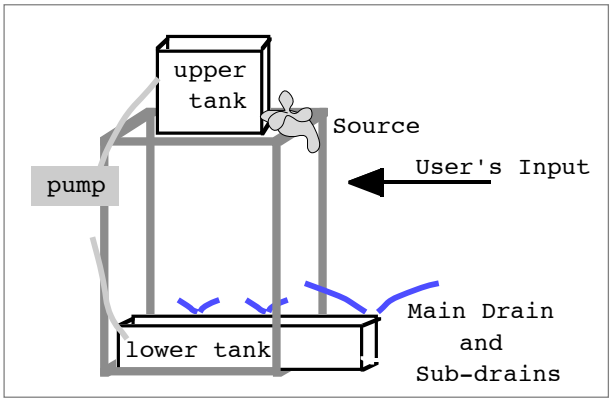


Fig. 4

2) content description

As the user touches the water flow, the music changes as a result of the water being diverted to the different funnels. Musical scales are mapped to each drain, and the water flow makes musical harmony with musical tension. The amount of the lower flow determines the height of the MIDI note-number. We propose applying these tensions to convergence with the height of the sound mapping in this instrument by using a MIDI system. Four prepared chords are assigned to each drain. The value of the faucet source controls the duration of each note. When the volume of flow at each drain changes, a note-on signal is issued with these note-control signals. The four funnel drains are each assigned one of four chords in a 12-tone scale: "E-flat-major," "F-minor," "G-minor" and "A-flat-major" in descending order of the height of the drain. The value of the drains control the base note and the width of the sound range.

IMPACT

Tangible Sound transfers some of the characteristics of water into the sound of the music. It is pleasurable to experience the unstable flow of sound together with the physical sensation of water. The system configuration described here could be applied in any number of other watery contexts. For example, in the shower, we experience the flow of water all over the body, one of the great pleasures of life. Even outdoors, it could enhance our enjoyment

of the flow of the river. Any situation where we find flowing water could be used.

Tangible sound will be developed with further integration of media to accept more participants as performers and will be applied in musical instruments using multi-media feedback.

TECHNICAL

Tangible Sound #2 has sonic outputs made by water sensing. For measuring the upper flow, we use the radius of the flow under the faucet by sensing the resistance of water with nichrome wires (Fig. 5). The lower flow is also measured by resistance of the lower water. Funnels are prepared as drains, and in each drain we installed nichrome wires for sensing water level, which is used to measure the volume of lower flow. The level is raised when the volume exceeds the draining capacity of the funnel (Fig. 6).

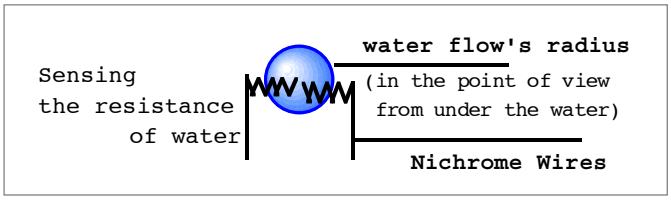


Fig. 5

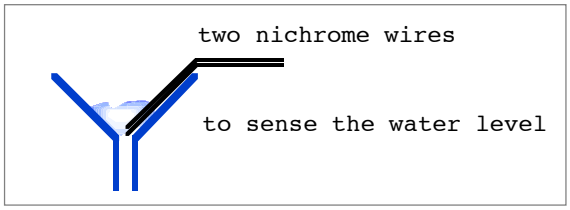


Fig. 6

To connect these sensor systems, we adopted the i-Cube system to change the analog signals into digital (MIDI) signals. Next, through the MIDI interface, we decided to send MIDI signals to Macintosh system for making sound output.

The software was constructed with two programs. Music outputs are programmed in Max/MSP MIDI programming language by a Macintosh G4.

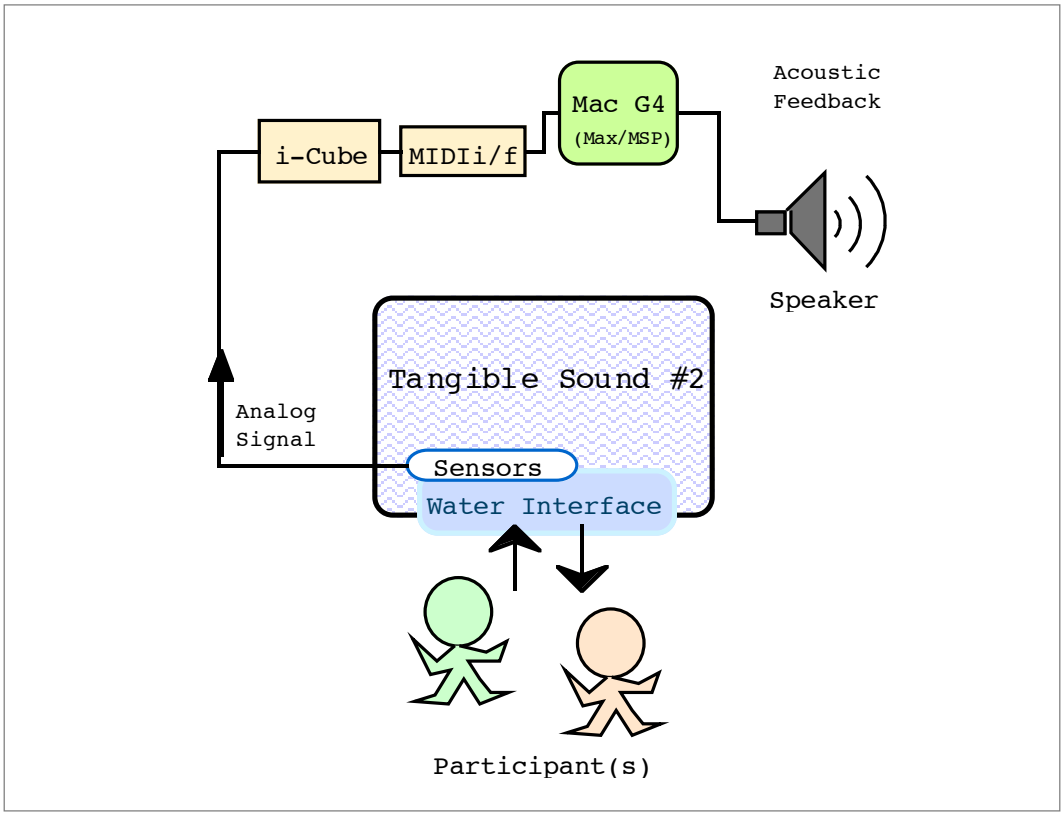


Fig.7

Equipment

Macintosh G4 (possibly Highend iMac/iBook)

I-Cube system (infusion systems)
MIDI Interface (MOTU MIDI EXPRESS XT)
Speaker Set (YAMAHA MSP5 * 2 speakers)

Pump
Light
Water Tank * 2
Faucet
Special Funnel * 4
Aluminium Flame Set (Include Alminium Board * 2)
Desk Under the System

Equipment that we need to have provided:
Desks (W:60" H:40" D:50"),
(W:120" H:40" D:40")
Several chairs

Power Required

Mac	3A *110V =		330W
display	0.6A * 120V=		60W
i-cube	1A * 7.5V =		7.5W
pump	2A * 100V =		200W
light	0.3A ,		30W
speaker - L	0.45 A	->	45W
speaker - R	0.45 A	->	45W
MIDI i/f	1A		50W

total amount: **768 W (VA) :**

for surplus and other materials added later,

1,500W.

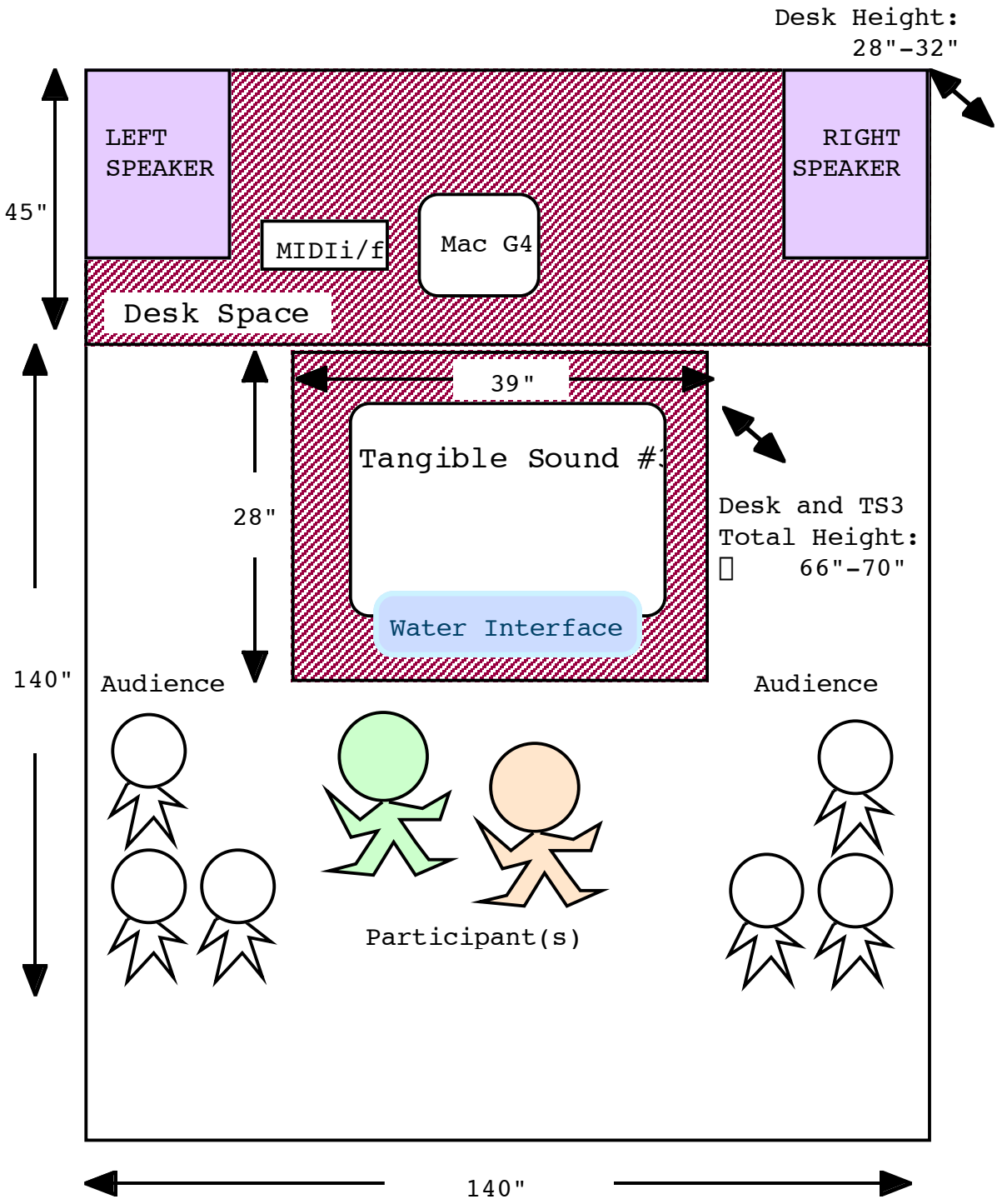
PHYSICAL

% *Dimensions we require are* Width=**140**"(inches), Depth=**185**", Height=**120**".
% **1,500W (VA)** *Power*
% **1 * 10 Mbps** *Internet Access required.*
% *Much noise will be generated* **"Highly":** *a quiet area is* **"Somewhat important"**.
% *Estimated set-up time:* **2** hours, *disassembly time:* **2.5** hours
% **Plans** *and* **Elevations** *Detail Figures:*
(1) plan [floor plan] -> see Fig. 8
(2) elevation [system elevation] -> see Fig. 9

NETWORK

We require **one 10 Mbps bandwidth Ethernet** Network connected to the Internet, and a Macintosh G4. **128 M** memory, network software includes **Fetch**, **Netscape**, **Telnet**, **Eudora**.

Proposed Layout Plan of Tangible Sound #2 Exhibit (Fig. 8)



Proposed Layout Elevation Plan of Tangible Sound #2 Exhibit (Fig. 9)